Sacramento Valley Groundwater Basin, Yolo Subbasin

- Groundwater Basin Number: 5-21.67
- County: Yolo, Solano
- Surface Area: 256,000 acres (400 square miles)

Boundaries & Hydrology

The Yolo Subbasin, located in the southern portion of the Sacramento Valley Basin primarily within Yolo County. It is bounded on the east by the Sacramento River, on the west by the Coast Range, on the north by Cache Creek, and on the south by Putah Creek. The basin is roughly bisected by an anticlinal structure, but otherwise is gently sloping from west to east with elevations ranging from approximately 400 feet at the base of the Coast Range to the west to nearly sea level in the eastern areas. Major cities within the subbasin include Davis, West Sacramento, Winters, and Woodland.

Precipitation averages approximately 20 to 24 inches per year in the western portion of the subbasin, and approximately 18 to 20 inches per year in the eastern portion of the subbasin.

Hydrogeologic Information

Water Bearing Formations

The primary water bearing formations comprising the Yolo subbasin are sedimentary continental deposits of Late Tertiary (Pliocene) to Quaternary (Holocene) age. Fresh water-bearing units include younger alluvium, older alluvium, and the Tehama Formation (Olmstead, 1961 and DWR, 1978). The cumulative thickness of these units ranges from a few hundred feet near the Coast Range on the west to nearly 3000 feet near the eastern margin of the basin. Saline water-bearing sedimentary units underlie the Tehama formation and are generally considered the boundary of fresh water (Berkstresser, 1973).

Younger alluvium includes flood basin deposits and Recent stream channel deposits. Flood basin deposits occur along the eastern margin of the subbasin in the Yolo Flood Basin. They consist primarily of silts and clays, but along the eastern margin of the subbasin may be locally interbedded with stream channel deposits of the Sacramento River. Thickness of the unit ranges from 0 to 150 feet. The flood basin deposits have low permeability and generally yield low quantities of water to wells. The quality of ground water produced from the basin deposits is often poor.

Recent stream channel deposits consist of unconsolidated silt, fine- to medium-grained sand, gravel and occasionally cobbles deposited in and adjacent to active streams in the subbasin. They occur along the Sacramento River, Cache Creek, and Putah Creek. Thickness of the younger alluvium ranges from 0 to 150 feet.

The younger alluvium varies from moderately to highly permeable, but often lies above the saturated zone. Where saturated, the younger alluvium yields significant quantities of water to wells.

Older alluvium consists of loose to moderately compacted silt, silty clay, sand, and gravel deposited in alluvial fans during the Pliocene and Pleistocene. Thickness of the unit ranges from 60 to 130 feet, about one-quarter of which is coarse sand and gravel. Permeability of the older alluvium is highly variable. Wells penetrating sand and gravel lenses of the unit produce between 300 and 1000 gpm. Adjacent to the Sacramento River, wells completed in ancestral Sacramento River stream channel deposits yield up to 4000 gpm. Wells completed in the finer-grained portions of the older alluvium produce between 50 and 150 gpm.

The Tehama Formation is the thickest water-bearing unit underlying the Yolo subbasin, ranging in thickness from 1500 to 2500 feet. Surface exposures of the Tehama Formation are limited mainly to the Coast Range foothills along the western margin of the basin, as well as in the Plainfield Ridge. The Tehama consists of moderately compacted silt, clay, and silty fine sand enclosing lenses of sand and gravel, silt and gravel, and cemented conglomerate. Permeability of the Tehama Formation is variable, but generally less than the younger units. Because of its relatively greater thickness, however, wells completed in the unit can yield up to several thousand gallons per minute.

Underlying the Tehama Formation are brackish to saline water-bearing sedimentary units, including the somewhat brackish sedimentary rocks of volcanic origin (Pliocene to Oligocene?) underlain by marine sedimentary rocks (Oligocene? to Paleocene) which are typically of low permeability and contain connate water (Olmstead, 1961). The upper contact of these units generally coincides with the fresh/saline water boundary. The contact is found near the Coast Range at depths as shallow as a few hundred feet. Near the eastern margin of the basin it reaches depths of nearly 3000 feet.

Subsurface Flow Controls

The geologic structure of the groundwater subbasin is dominated by an anticlinal ridge oriented northwest to southeast, which is expressed at the surface as the Dunnigan Hills and Plainfield Ridge. The anticlinal structure impedes subsurface flow from west to east. Subsurface groundwater outflow sometimes occurs from the Yolo subbasin into the Solano subbasin to the south. Subsurface outflow and inflow may also occur beneath the Sacramento River to the east with the South and North American subbasins. Subsurface groundwater inflow may occur from the west out of the Capay Valley Basin.

Groundwater Level Trends

Groundwater levels are impacted by periods of drought due to increased groundwater pumping and less surface water recharge (e.g. in the late 1970's and early 1990's), but recover quickly in "wet" years. Long term trends do not indicate any significant decline in water levels, with the exception of localized pumping depressions in the vicinity of the Davis, Woodland and Dunnigan/Zamora areas. Past studies (Scott, 1975) have concluded that the

Yolo subbasin is subject to overdraft, however the completion of Indian Valley Reservoir in 1976 provided significant relief in the form of additional available surface water (YCFCWCD, 2000).

Groundwater Storage

Many studies have been conducted to determine the groundwater storage within parts or all of Yolo County. Several of these studies refer to calculations completed by Scott and Scalmanini in their 1975 report, Investigations of Groundwater Resources, Yolo County. Groundwater storage capacity for the entire county for groundwater aquifer depths between 20 and 420 feet was calculated as 14,038,000 acre-feet based on subtotals from six separate study areas. Specific yields were calculated, based on well log information, for three separate depth intervals within six study areas, and ranged from 6.5% to 9.7%.

Groundwater Storage Capacity. From the Scott and Scalmanini calculations it can be roughly estimated that the Yolo Subbasin, (defined in this report as a portion of the county) has a total storage capacity of 6,455,940 acre-feet for depths between 20 and 420 feet (see below).

Table: Storage capacity was calculated based on Scott (1975) as follows:

Groundwater Basin (Scott, 1975)	Area (acres)	Calculated Gross Storage Capacity (Scott, 1975)	Estimated % area within Yolo Subbasin[1]	Estimated Storage Capacity within Yolo Subbasin[1]
Cache Creek	45,800	1,678,100	20%	335,620
Upper Cache-Putah	70,300	2,017,700	100%	2,017,700
Plainfield Ridge	8,800	240,800	100%	240,800
Lower Cache-Putah	97,300	2,876,900	95%	2,733,055
Colusa	95,700	2,709,800	0%	0
Yolo Bypass	129,100	4,514,700	25%	1,128,765
Totals	**447,000**	**14,038,000**		**6,455,940**

[1]Represents the portion of each Groundwater Basin (as defined by Scott, 1975) that is contained within the Yolo Subbasin (as defined by the DWR). Percentages were estimated by DWR staff.

Groundwater in Storage. Groundwater storage between the depths of 20 to 420 feet in 1974 for all of Yolo County was calculated to be 13,208,400 acre-feet (Scott, 1975). Based on the Scott report, groundwater storage within the Yolo Subbasin for 1974 is estimated at 6,074,220 acre-feet (see below).

Table: 1974 groundwater storage calculations based on Scott (1975):

Groundwater Basin (Scott, 1975)	Area (acres)	1974 Calculated Storage (Scott, 1975)	Estimated % area within Yolo Subbasin[1]	Estimated 1974 Storage within Yolo Subbasin[1]
Cache Creek	45,800	1,528,700	20%	305,740
Upper Cache-Putah	70,300	1,921,000	100%	1,921,000
Plainfield Ridge	8,800	189,400	100%	189,400
Lower Cache-Putah	97,300	2,677,400	95%	2,543,530
Colusa	95,700	2,433,700	0%	0
Yolo Bypass	129,100	4,458,200	25%	1,114,550
Totals	**447,000**	**13,208,400**		**6,074,220**

[1]Represents the portion of each Groundwater Basin (as defined by Scott, 1975) that is contained within the Yolo Subbasin (as defined by the DWR). Percentages were estimated by DWR staff.

Groundwater Budget (Type C)

Currently no groundwater budget has been calculated for the Yolo Subbasin (see comments below).

Groundwater Quality

Groundwater found within the subbasin is characterized as a sodium magnesium, calcium magnesium, or magnesium bicarbonate type. The quality is considered good for both agricultural and municipal uses, even though it is hard to very hard overall (generally over 180 mg/l $CaCO_3$). Selenium and boron are found in higher concentrations locally (Evenson, 1985). Total dissolved solids range from a of 107 ppm to 1300 ppm and average 574 ppm, based on Title 22 data obtained from public supply water well samples (DHS, 2000).

Localized impairments include elevated concentrations of boron (as high as 2 to 4 ppm) in groundwater along Cache Creek and in the Cache Creek Settling Basin area, increased levels of selenium present in the groundwater supplies for the City of Davis, and localized areas of nitrate contamination. (YCFCWCD 1992) (Evenson, 1985)

Water Quality in Public Supply Wells

Constituent Group[1]	Number of wells sampled[2]	Number of wells with a concentration above an MCL[3]
Inorganics – Primary	61	3
Radiological	53	0
Nitrates	67	1
Pesticides	59	0
VOCs and SOCs	59	1
Inorganics – Secondary	61	11

[1] A description of each member in the constituent groups and a generalized discussion of the relevance of these groups are included in *California's Groundwater – Bulletin 118* by DWR (2003).
[2] Represents distinct number of wells sampled as required under DHS Title 22 program from 1994 through 2000.
[3] Each well reported with a concentration above an MCL was confirmed with a second detection above an MCL. This information is intended as an indicator of the types of activities that cause contamination in a given basin. It represents the water quality at the sample location. It does not indicate the water quality delivered to the consumer. More detailed drinking water quality information can be obtained from the local water purveyor and its annual Consumer Confidence Report.

Well Characteristics

	Well yields (gal/min)	
Municipal/Irrigation	Range: 150 – 4000+	Average: 1500 (estimate)
	Total depths (ft) [1]	
Domestic	Range: 40 - 600	Average: 230 (estimate)
Municipal/Irrigation	Range: 50 - 1500	Average: 400 (estimate)

[1]Based on DWR data.

Active Monitoring Data

Agency	**Parameter**	**Number of wells /measurement frequency**
DWR	Groundwater	10 semi-annually; 4 monthly
YCFC&WCD	Levels	92 semi-annually; 1 monthly
Sacramento County		1 semi-annually
USBR		12 semi-annually; 7 monthly
DHS	Water Quality	133 annually
DWR	Ground Subsidence	1 continuously

Basin Management

Groundwater management:	R.D. 108 adopted AB3030 plan 2/95 R.D. 2035 adopted AB3030 plan 4/95 R.D. 2068 adopted AB3030 plan 1/97 Yolo County Flood Control and Water Conservation District are drafting plan but not pursuant to AB3030 R.D. 900, City of West Sacramento is not drafting AB3030 plan
Water agencies	
Public	Yolo County Flood Control and Water Conservation District City of Woodland, City of Davis, City of West Sacramento
Private	R.D. 108, 900,2035, 2068

Comments:

Although groundwater budgets have been previously calculated for areas overlying the Yolo Subbasin, no groundwater budget has been calculated for the Yolo Subbasin as defined by this report.

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